

U.S. PATENT APPLICATION NO. 10/667,296
ATTORNEY DOCKET NO.:061459 303139

Amendments to the Claims:

The listing of claims below replaces all previous versions of the claims in this application.

1. (Currently Amended) An automatic drilling system, comprising:
an electric servo motor ~~operatively coupled~~ arranged to operate a winch brake control;
a servo controller operatively coupled to the servo motor; and
a drum position encoder rotationally coupled to a winch drum and operatively coupled to the servo controller, the servo controller adapted to operate the servo motor in response to measurements of position made by the encoder so that a selected rate of rotation of the winch drum is maintained.
2. (Original) The system of claim 1 wherein the encoder comprises a sine/cosine output transducer.
3. (Original) The system of claim 1 wherein a winch brake operated by the winch brake control comprises a band brake.
4. (Original) The system of claim 1 wherein the selected rate of rotation is related to a selected rate of axial motion of a drill string.
5. (Original) The system of claim 1 further comprising a drilling fluid pressure sensor operatively coupled to the servo controller, the servo controller adapted to control the rate of rotation so as to substantially maintain a predetermined drilling fluid pressure.
6. (Original) The system of claim 1 further comprising a bit weight sensor operatively coupled to the servo controller, the controller adapted to control the rate of rotation so as to substantially maintain a predetermined axial force on a drill bit.
7. (Original) The system of claim 1 further comprising a logic switch selectable to conduct one

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or more of a plurality of control signals to the servo controller, the control signals setting the selected rate of rotation.

8. (Original) The system of claim 7 wherein the control signal comprises at least one of drilling fluid pressure, axial force on a drill bit, rate of penetration of a drill bit, wellbore inclination and wellbore azimuth.

9. (Original) The system of claim 1 further comprising a rate optimizer operatively coupled at an input thereof to at least one drilling operating parameter sensor, an output of the optimizer operatively coupled to the servo controller, the optimizer adapted to calculate a rate of axial motion of the drill string in response to measurements of the at least one drilling operating parameter.

10. (Original) The system of claim 9 wherein the at least one drilling operating parameter sensor comprises a weight on bit sensor.

11. (Original) The system of claim 9 wherein the at least one drilling operating parameter sensor comprises a drill string torque sensor.

12. (Original) The system of claim 9 wherein the at least one drilling operating parameter sensor comprises a drill string rotation rate sensor.

13. (Original) The system of claim 9 wherein the at least one drilling operating parameter sensor comprises a sensor measuring a parameter related to axial position of the drill string.

14. (Original) The system of claim 13 wherein the axial position sensor comprises the drum position encoder.

15. (Original) The system of claim 9 wherein the at least one drilling operating parameter sensor comprises a sensor measuring a parameter related to a wellbore trajectory.

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16. (Original) The system of claim 1 wherein a resolution of the encoder is about four million output increments per revolution of the drum.

17. (Currently Amended) A method for controlling a rate of release of a drill string, comprising:

measuring a parameter related to rotational position of a drawworks drum;

measuring a parameter related to operating position of a drawworks brake;

determining a rate of rotation of the drum from the rotational position related parameter measurement; and

adjusting the operating position of the brake so as to substantially maintain the rate of rotation at a selected value using the measured operating position parameter and the measured rotational position parameter.

18-26 (Canceled)

27. (Currently Amended) An automatic drilling system, which comprises:

an electric servo motor coupled to a drawworks winch drum brake actuator so as to operate the actuator;

means for determining drawworks winch drum speed of rotation; and

means for controlling said servo motor based upon a difference between said drawworks winch drum speed of rotation and a speed of rotation set point.

28. (Previously Amended) The automatic drilling system as claimed in claim 27, wherein said means for determining includes: a rotary encoder coupled to said drawworks winch drum; and, means coupled to said rotary encoder for calculating said drawworks winch drum speed of rotation.

29. (Previously Amended) The automatic drilling system as claimed in claim 27, wherein said means for controlling said servo motor includes: a comparator for comparing said drawworks winch drum speed of rotation with said speed of rotation set point.

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30. (Previously Amended) The automatic drilling system as claimed in claim 27, wherein said means for controlling said servo motor includes: means for setting an angular position set point for said servo motor based upon said difference between said drawworks winch drum speed of rotation and said said speed of rotation set point.

31. (Previously Amended) The automatic drilling system as claimed in claim 30, including: means for determining the angular position of said servo motor; and, means for comparing said angular position of said servo motor with said angular position set point.